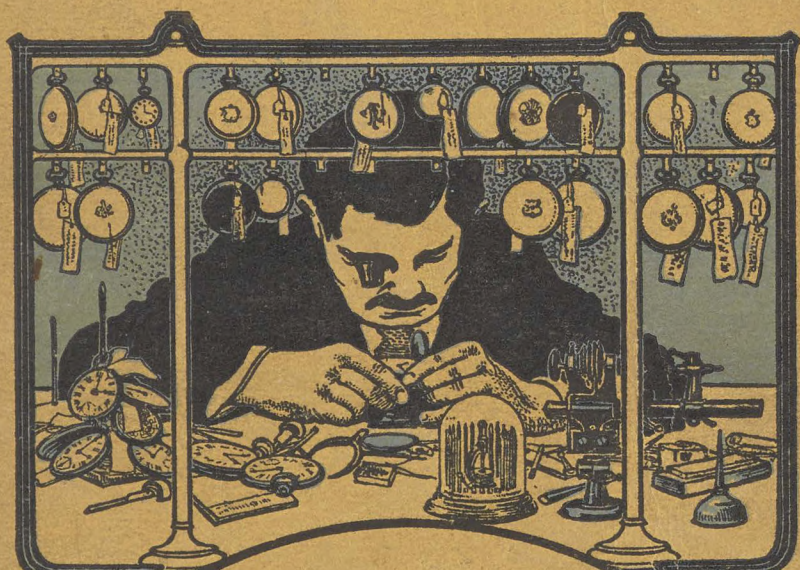


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LESSON NO. 6

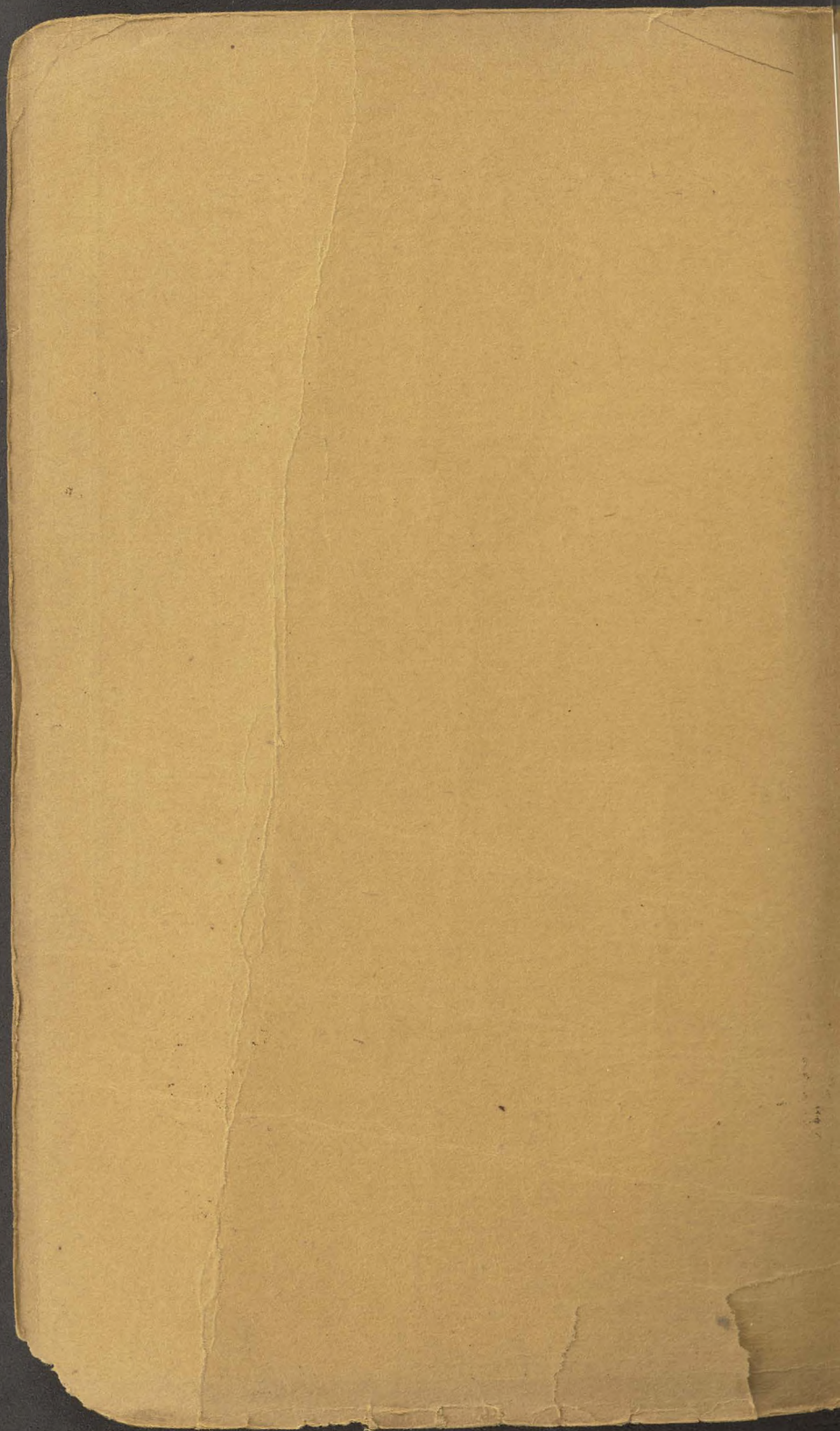
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Jewelers Wholesale
Supply House

CHICAGO, U.S.A.





LESSON NO. 6

Paragraph No. 1

How to Select a Hairspring

☐ The hairspring is the motive power that gives the balance wheel its reverse motion. The balance wheel is the pendulum of the watch. It must be in perfect beat or the movement will not run accurately. If a clock is not level, the pendulum will not swing evenly. If a hairspring is not properly adjusted, the balance wheel will act like the clock pendulum, and must be repaired. You should proceed as follows: Select a hairspring of correct size by placing the hairspring collet over the balance jewel in the balance bridge. When in this position, the outer coils should not extend beyond the hairspring stud, as it will throw the spring out of position when fastened. (See figure 1.) Place the spring on the balance staff. Rest the lower balance pivot on a hard smooth surface like glass and with tweezers take hold of the outer coil of the spring where it enters the curved pins. Raise the tweezer until balance staff is held upright and gently vibrate the balance wheel. Then count the number of beats. This is done by having a watch with which you time them. An ordinary American movement beats 300 times a minute. (See figure 2.) If the number is less, move the tweezers in on the coil of spring. If there are too many beats, move tweezer toward outer end of spring. When you have produced the beats as near as possible, slightly bend the hairspring where tweezers are holding

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it, so as to tell where it is to enter regulator pins, then pin the end to the stud and adjust the hairspring to the balance wheel by using Wathier's Hairspring Index No. 3801. (Directions accompany this tool. It can be used on all size watches.)

Paragraph No. 2

How to Set a Pallet Stone

¶ To insure perfect work, I would advise you to use our No. 3206 pallet stone adjuster, and proceed as follows: If the pallet stones are loose, place the pallet fork and arbor in the tool as shown in figure 3, then hold the plate of the tool in the flame of your alcohol lamp until the shellac softens. (See figure 3B.) The plate will retain the heat and keep the shellac soft while you move the stones into proper position. When the parts are cool and the shellac has hardened, remove the pallet fork, put it in place in the movement and test the escapement. If the pallet stones are not properly adjusted, you must repeat the operation until the escapement is perfect. When fitting new pallet stones, examine them very carefully with your eye-glass. See that the ends are not chipped, also notice the level on the ends of them and see that they are properly placed in the pallet. The ends are not alike. One is called the receiving and the other the discharging stone. (See figure 4.) Be careful and not use too much heat when doing this work. Shellac melts very easily. Do not use too much shellac and remove all traces of it from the pallet and stones with a small pointed instrument, before placing the pallet in the movement. A good tool for this purpose can be made with a piece of small copper wire filed to a point on one end.

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Paragraph No. 3

Information Regarding the Canon Pinion

¶ The canon pinion is a very important factor in a watch movement. (See figure 5.) The pinion is hollow and is carried on the center staff where it is held in place by friction. The adjustment of this friction must be perfect for the following reasons. If the canon pinion is rigid on the center staff, the watch hands cannot be moved with the setting attachment. If the canon pinion is too loose on the center staff, the hands will not move when the movement is running. Figure 6 shows the cannon pinion in its place, also the minute wheel and setting attachments. The canon pinion revolves once every hour and carries the minute hand. The hour wheel fits over the canon pinion and is made to revolve once every twelve hours by the minute wheel pinion. The teeth of this pinion mesh with the hour wheel teeth, as shown in figure 8. A test of the setting attachment with the dial removed will demonstrate why the canon pinion must have the proper amount of resistance on the center staff. If for any reason the canon pinion is too loose on the center staff, you should tighten it by using our No. 2610 canon pinion tool. Place a wire in the pinion and put same in the tool as shown in figure 9. A very gentle tap on the punch will cause an indentation that will act as a spring and securely hold the pinion on the center staff.

Paragraph No. 4

How to Make a Balance Staff

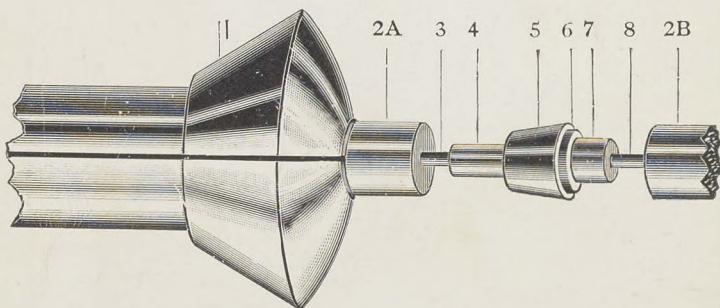
¶ Select a piece of staff wire from your box of Stubbs' steel staff wire that is the same thickness as the old staff.

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Use your degree gauge for making measurement. Place the wire in a chuck of suitable size then fasten the chuck in your lathe. The staff is cut with a graver held in position on the T rest of the lathe. Use a diamond shape graver and have the T rest about one quarter of an inch from the staff. Figure 11 shows the correct angle and the style of graver that should be used when cutting a square shoulder. The following illustration is an enlarged cut of the balance staff held in the lathe chuck:



Balance Staff and Lathe Chuck

No. 1. Is the lathe chuck in which staff wire is fastened.

No. 2A. Staff wire unfinished.

No. 3. Finished pivot that goes in lower hole jewel.

No. 4. Shoulder on which roller table is fastened.

No. 5. Hub on which roller table and balance wheel rest.

No. 6. Shoulder on which balance wheel is fastened.

No. 7. Shoulder on which hair spring collet is fastened.

No. 8. Finished pivot that goes in upper hole jewel.

No. 2B. Staff wire unfinished.

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¶ Proceed as follows: First turn No. 6, then No. 7, then No. 8, then cut off No. 2B. Now see that measurements are exact by trying the balance wheel, hair spring collet and upper hole jewel. Then finish and polish the three parts that have been turned. Now reverse the staff and fasten in chuck on shoulder No. 7; place it in up to shoulder No. 6; then turn Nos. 5, 4 and 3 in order named; cut off wire; see that roller table and lower hole jewel fit; then finish and polish as described in Lesson No. 5, Paragraph No. 5. See that your graver is sharp. You can keep it in good condition with oil stone No. 4825. Do not use too much pressure or you will chip the graver and spoil your work.

Paragraph No. 5

How to Set Plate Jewels

¶ Plate jewels do not always have original settings as shown in figure 12, but are held in place by a setting that has been made in the movement plate. My instructions will apply to the unset jewels because a plate jewel with its own setting can be replaced as described in Lesson No. 3, Paragraph No. 1. When replacing an unset jewel, first repair the setting in the plate, remove the broken jewel. Then prepare the setting with Crosby's jewelng tool No. 3107. Insert the bezel opener in the jewel hole. Have the jaws of the opener rest on the jewel seat. (See figure 13.) Then tighten the thumb screw and revolve the tool between the thumb and forefinger. This will open and prepare the setting for the new jewel. Do not use too much force or you will break the jaws of the tool. Now select a jewel that will fit the pivot of the pinion and also fits the setting. Place it in

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the setting and select a jewel closer of suitable size, place it in the tool and hold directly over the jewel. Revolve the tool between your thumb and forefinger, using considerable pressure. This operation will close and burnish the bezel which holds the jewel in place. When putting in the jewel see that the countersunk surface is facing up. It acts as an oil cup and keeps the pivot lubricated.

To Engrave on Steel

☐ Heat slightly the piece to be engraved; rub with bees-wax so as to obtain a thin covering when cold; engrave on the wax so as to reach the metal; soak in strong vinegar, then sprinkle over the engraving corrosive sublimate wet with vinegar. In five minutes melt and wash off the wax.

To Engrave on Copper—New Method

☐ Coat the copper with any of the silvering solutions described; cover it with colored varnish, then draw the lines with a sharp point in the manner of using a diamond for stone engraving, and etch them in with perchloride of iron.

To Extract Silver from Waste Products

☐ Mix your refuse with an equal quantity of wood charcoal, place in a crucible and submit to a bright red heat, and in a short time a silver button will be found at the bottom. Carbonate of soda is another flux.

To Fasten Ribbons in Mountings for Chains

☐ Ribbons are fastened into metal tips with shellac. Heat the shellac and work it into a stick. Then heat the

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stick and smear some on the ends of the ribbon. The tips should also be heated when the end of the ribbon covered with shellac is pushed in.

Focal Distance of Spectacle Glasses

☾ Place the end of a measure of thirty or forty inches in length against a smooth wall, or other suitable ground, in plain view of some well defined object a few rods distant, for instance, a building or window on the opposite side of the street. Then place the edge of your lens on the measure and move it backward or forward until a spectrum is formed, or, in other words, until a clear and distinct outline of the distant object is produced on the ground against which your measure rests. This point will represent sufficiently near for all practical purposes the exact focal distance of the lens, and will correspond in inches with the number on all properly **marked** convex spectacles. For mending fine steel spectacle frames use the best gold solder in preference to silver or brass solder.

The Firmness of Steel

☾ In order to test the firmness of steel, take several bars of equal thickness, of different kinds, harden them, and after having annealed them equally, say blue, try to bend them until they break by fastening them in the vise. Those bars that can be bent at the greatest angle before breaking are of course the toughest. Adverse tough steel does not break as dry as a vitreous kind, and its fracture shows places like torn fibers.

Frosting Steel Work

☾ After the work has been prepared with a surface free from scratches, it is rubbed with a short backward and

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forward motion on a small glass slab with a thickish paste of oilstone-dust and sweet oil. Before mixing this paste, look over the pounded oilstone with a very strong magnifying glass, and carefully remove all the black stones which, if left, would inevitably scratch the work. The work is cleaned and finished by rubbing in a circular direction with pith, or, instead of rubbing with pith, the work may be carefully breaded and immersed in benzine.

How to Hard Solder

☐ First fit up the joint and secure with binding wire if possible, then cover all portions of the joint with flux, secure the work on a piece of asbestos or soft charcoal, and with a blowpipe turn the flames on the joint until fusion takes place; after which the work is ready to be dressed up. To restore the color of gold or silver, expose to a uniform heat, then immerse in a solution composed of one part sulphuric acid to eight of soft water, polish as usual.

To Temper Small Steel Parts

☐ I temper pinions and other small steel parts in the following simple manner: I take a thin piece of copper, say from an old dial, scrape soap upon it, bend it together, and lay the article between; I then bend the sheet firmly together, and make it red-hot upon a coal, and then anneal it in oil. Not even the most delicate object will warp in this manner.

To Draw the Temper from Delicate Steel Pieces Without Springing

☐ Place the article from which you desire to draw the temper into a common iron clock key. Fill around it with brass or iron filings, and then plug up the open end

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with a steel, iron or brass plug, made to fit closely. Take the handle of the key with your pliers and hold its pipe into the blaze of a lamp till nearly hot, then let it cool gradually. When sufficiently cool to handle, remove the plug, and you will find the article with its temper fully drawn, but in all other respects just as it was before. You will understand the reason for having the article thus plugged up while passing it through the heating and cooling process, when I tell you that springing always results from the action of changeable currents of atmosphere. The temper may be drawn from cylinders, staffs, pinions, or any other delicate pieces, with perfect safety by this mode.

Dip for Cutting Tools

☐ A French engraver has discovered that the engraving tool will cut much more readily into metals which ordinarily were impenetrable if the tool is occasionally dipped into petroleum. The hardest steel, however, is engraved easily, if the tool is dipped into a solution of two parts of petroleum with one part of turpentine.

To Preserve Pencil Drawings

☐ Pencil drawings may be preserved in the following manner: Soften white wax in rectified oil of turpentine and rub this gelatinous mass gently over the drawing. The white wax will form a coating on the paper after the evaporation of the turpentine.

To Put Lenses in Rubber Frames

☐ Heat the frames as hot as you can handle them, when they become plastic, then press the lenses in.

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Pin Tongues

☪ Do not make your points too blunt. Select a tongue a little long and cut it off rather than try to find one the right length. Use a fine oil stone to smooth up the point; you will find it will go through the goods much easier. Always burnish the tongue before putting it in, and be sure it has spring enough to keep it well up into the catch. Always buy a good quality of pin tongues and keep a large assortment on hand. Do not give much taper to your rivet and have the tongue move on the rivet always. Have it fit snug enough so as not to have any joint shake.

How to Make Cement

☪ Finely pulverized oxide of lead mixed with glycerine will make one of the best cements known, being impervious to water and almost all acid, and acting well on iron, stone, etc.

Benzine

☪ Dirty benzine may be again rendered fit for use by filtering through animal charcoal. One of our friends stops the end of an ordinary pint glass funnel with paper and presses therein calcined bone-dust until it is about three parts full. On the top of this is poured the benzine to be filtered.

How to Test Silver

☪ If in doubt whether an article is of pure silver or an alloy, scrape a small spot and apply nitric acid. If the acid leaves a whitish film the article is pure silver; if not, it is an alloy.

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Reviver for Old Jewelry

☐ Dissolve sal-ammoniac in urine, and put the jewelry into it for a short time; then take it out and rub with chamois leather, and it will appear equal to new.

To Draw Gold Stripes

☐ First draw the lines with a sticky varnish or with gold size. When this is a little dry or sticky, technically called "tacky," gold leaf is applied or the bronze powder dusted on, and the sizing is allowed to dry, when the superfluous material is brushed off.

Jewelry Cleansing Powder

☐ Mix and pulverize forty parts saltpeter, five parts sal ammoniac, twenty-five parts alum and thirty parts sea salt. Keep in boxes or bottles. Rub it on the jewelry with a rag wet with water or brandy, and wipe dry with dry rag or chamois skin.

Drilling Tempered Steel

☐ Make the drill oval, instead of giving it the usual form, and temper it as hard as possible without burning. Touch the surface of the metal to be acted on with a little dilute nitric acid, so as to render it slightly rough. Lubricate the drill from time to time with essence of turpentine instead of oil (some workmen use kerosene, or good rectified petroleum in which camphor has been dissolved). When the drill will catch no longer, clean the hole at the bottom with the turpentine or kerosene, with the addition of a little acid, and continue the operation. This method is a little complicated, but it is the only safe way for drilling steel.

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To Drill Porcelain

¶ It is sometimes necessary to drill one or more holes into porcelain, but the usual way in which it is performed is far from easy. If, however, an ordinary drill is hardened and kept moist with oil of turpentine, it will easily penetrate the porcelain. The drill commonly employed in connection with scroll-cutting machinery answers the purpose well.

Why Gold in Jewelry Changes Color

¶ It is well known that the human body contains humors and acids, similar in action to and having a like tendency toward baser metals, as nitric and sulphuric acids have, namely, to tarnish or dissolve them, varying in quality in different persons. Thousands wear continually, without any ill effects, the cheaper class of jewelry, with brass ear-wires, while if others wore the same article for a few days they would be troubled with sore ears, or, in other words, the acids contained in the system would so act on the brass as to produce ill results. Instances have occurred in which articles of jewelry of any grade below eighteen carats have been tarnished in a few days, merely from the above-named cause. True, these instances are not very frequent; nevertheless, it is well to know them. Every case is not the fault of the goods not wearing well, as it is generally called, but the result of the particular constitution of the wearer.

Hardening

¶ The operation of increasing the hardness of steel is by heating it to redness and then cooling it suddenly. Bright steel should not be exposed naked to a fire or flame. It

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may with advantage be placed in a covered box containing bonedust or animal charcoal in some other form; or another plan is to smear soap all over the articles to be hardened. Water or oil is the medium generally selected for plunging the article in to cool it. Petroleum is recommended if extra hardness is desired. Either mercury or salt water will give great hardness, but the steel is rendered brittle. Oil is the best medium for hardening steel if toughness is desired.

To Prevent Tarnish of Silverware

☞ Tableware and other articles of silver, as well as plated, almost invariably tarnish, especially if stove coal is burned either in the house or neighborhood, because the sulphur contained in the former blackens the silver. This may be completely protected by coating it with a fine brush with collodion, which has previously been diluted pretty strongly with alcohol. This coating dries at once and forms a very thin, transparent and invisible protection which shields the silver completely, and, if necessary, may be washed off with hot water. This process is much employed in English silver stores.

Oil Stones

☞ If the watchmaker's oil stones are without boxes, he cannot do better than buy them. Good oil stones, kept in good, clean condition, are a means of first importance in keeping tools as they ought to be kept. With a covered oil stone, the oil upon it is kept in a liquid state for as long a time as it can be. The oil not becoming sticky, the pores of the stone do not, as they otherwise would, become filled with a gummy substance that diminishes

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its power, if it does not destroy it altogether. With stone and oil clean, the work of sharpening gravers and tools is rapidly and easily done.

Clock Case or Furniture Polish

☐ A very satisfactory polish can be obtained by mixing in a tea saucer or other open vessel four parts of shellac dissolved in alcohol until as thick as molasses, one part boiled linseed oil and one part spirits turpentine, in which is dissolved a little camphor gum. No more of the composition should be mixed than is intended to be used at the time. The composition is applied with a woolen rag and rubbed with it until quite dry.

Violin Varnish

☐ The "Scientific American" gives the following formula for preparing a beautiful varnish for violins: Rectified alcohol, half gallon; add six ounces gum sandarac, three ounces gum mastic, and half pint turpentine varnish; put the above in a tin can by the stove, frequently shaking until well dissolved. Strain and keep for use. If you find it harder than you wish, thin with more turpentine varnish.

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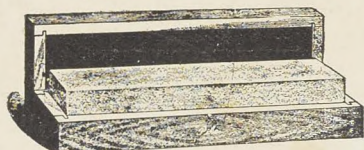
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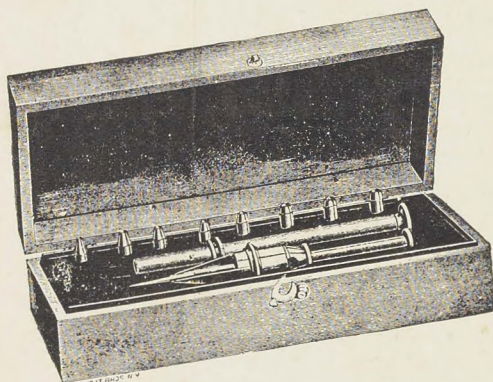
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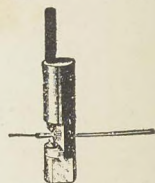
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*We will sell any of the articles in this outfit separately at the prices quoted. Lesson No. 6 Outfit contains all of the tools and material necessary for following the instructions in this lesson, providing you have the tools called for in Lessons No. 1, 2, 2, 4 and 5. The outfit is composed of the following articles:

\$6.00 CONTENTS \$6.00

1 No. 4825 Oil Stone.....	\$0.55	1 No. 3107 Jewelry Tool.....	\$1.50
1 No. 2231 Dial Brush.....	.25	1 No. 2610 Canon Pinion Tool...	.45
1 No. 5401 Box Pivot Wire.....	.20	1 No. 3801 Hairspring Index....	1.50
1 No. 5402 Box Staff Wire.....	.25	1 No. 3206 Pallet Stone Adj.....	.60
1 No. 3805 Bench Key.....	.20		
1 No. 4707 Screw Driver.....	.75		
1 No. 262 Bushing Wire.....	.35	Special 10% Discount....	.60
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SUPPLEMENT TO LESSON No. 6

The Escapement

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Paragraph No. 1

A watch excels all other machines in that it performs its sole function of indicating time with a precision that is truly marvelous when we take in to consideration the usage it receives at the hands of even the most careful user. A variation of one vibration of the balance wheel in every one thousand would cause an error in time of more than one and one-half seconds in every twenty-four hours, thus rendering it useless as an accurate time-keeper; to secure a rate of thirty seconds a week, these vibrations must be less than one in every twenty thousand. If these facts were more generally understood, there would be fewer unreasonable customers. When we wind a watch we store up a certain amount of power in the mainspring. This power is transmitted to the balance wheel and is held in check by the escapement which doles it out in homeopathic doses of 432,000 impulses during a twenty-four hour interval between successive windings.

Paragraph No. 2

The escapement in a watch or clock movement is the mechanical device by which the motion of the balance wheel is controlled so that the power may be distributed uniformly. There are two kinds of escapement devices used

on modern watches. The lever escapement and the cylinder escapement (See figure 1 and 2). The cylinder escapement is used only on cheap imported Swiss watches and is becoming obsolete, as they can very seldom, if ever, be made to run accurately. You will notice in Figure 1 that the teeth of the escape wheel are being supported against the cylinder. The pressure of these teeth is what gives the balance wheel its impulse. I would not advise you to repair watches that are fitted with the cylinder escapement and will only give brief instructions regarding them.

Paragraph No. 3

CYLINDER ESCAPEMENT

Because of the nature of this escapement, you must bear in mind that it must be in perfect condition, if you are not going to do the work well, it would be better not to do it at all. The same care must be given to this work as in the better grade of watches. When first looking at the watch, the general appearance should be taken into account, and also the motion of the balance wheel. See that the wheel is true in the round and the flat, also see that the hairspring is in good condition. Test the beat, by listening to the watch while it is running. If the cylinder is properly set, the center of the impulse opening will be in a line with the small banking pin, inserted in the rim of the balance wheel (See Fig. 3), and if it is in beat, this banking pin should stand in a line with balance wheel center and the escape wheel center. The correction of the beat is made by shifting the hairspring around in the opposite direction to what the balance wheel would have to be moved to correct it. Try the action of the escape wheel teeth and the cylinder by slowly revolving the balance wheel. Notice if the tooth drops upon the locking surface or upon the rounded impulse edge of the cylinder. This will be indicated by a sluggish, jerky motion of the balance wheel. The teeth should have the same amount of free motion when they escape from either edge of the cylinder. The tops of the escape wheel teeth must not touch the top of the cylinder when held in any position, and you must see that the arms which support the escape teeth do not strike on the cylinder either on the bottom or at the top of the passage cut out to release them. The pin in the balance bridge, against which the banking pin strikes (See Fig. 4), should be bent in towards the balance wheel center until the banking pin will strike it, but the balance wheel must be free to vibrate. In these instructions I have used the term **Beat**, which means, the striking of the escape wheel upon the cylinder; this

produces the ticking sound, and when a watch is in beat, the sound will be uniform. When a watch is not properly adjusted, it is said to be out of beat. Always use the proper terms when writing for special instructions.

Paragraph No. 4

WHAT THE TERM "DROP" MEANS

In lever and cylinder escapements, there must be an amount of freedom allowed in the parts which come in contact with each other, to compensate for inaccuracies in workmanship. This rule also applies to the clock escapement. You must study this part of my instructions very carefully. Your success in watch repairing largely depends upon your thoroughly understanding the escapement. The motive power which runs the watch movement is in the mainspring. It is well to know that between 25 and 50 per cent of this power is lost in the escapement. This loss of power must be kept at a minimum. Figure 5 shows an escape wheel and clock verge. Tooth (A) has dropped onto the impulse pallet. It has moved to the extreme point and is ready to leave this support. Now pay strict attention. Notice the distance between tooth (B) of the escape wheel and locking point (C) of the clock verge pallet. There must be a lost motion before (B) meets (C). This lost motion is called the "Drop". If there was not lost motion (Drop) the escape wheel teeth would either bind on the pallet, or the excessive amount of friction would prevent the necessary free action and the movement would not run. One drop commences at the completion of the unlocking of the tooth from the impulse pallet (A) and the other one begins at the completion of the impulse and ends when the tooth drops upon locking pallet (C). The principle is the same in watches that have lever and cylinder escapements. The drop is known as inside or outside of the pallet (See Fig. 6). I think that it would now be advisable, for those who are inexperienced, to master these first four paragraphs thoroughly before continuing with the detailed instructions that will follow. I have tried to give the foregoing directions in a simple concise manner, and believe that any one with ordinary mechanical ability will understand the importance and meaning of the term "DROP."

Paragraph No. 5

Figure 7 shows all of the parts and tells all of the names of the parts that are used in connection with the lever escapement. These terms will

be used hereafter. An ordinary watch beats 300 times per minute. The pallet embraces three teeth as shown in Figure 8. When the tooth of the escape wheel rests against the locking face of the pallet stone, the balance wheel has revolved from left to right, when it unlocks, the direction has changed and at this instant the balance wheel has attained its maximum velocity, and the blow delivered by the roller jewel against the pallet fork drives it in the opposite direction. The most serious loss of power is occasioned by impact. When a body in motion is suddenly stopped by coming in contact with an immovable body, the combined force of its weight and momentum is transformed into heat. This is precisely what takes place in an escapement five times every second. The escape wheel impelled by the force of the mainspring starts up from a dead rest, and again comes to a dead rest, arrested by another tooth coming in contact with the opposite pallet stone. This one motion of the pallet will allow the wheel to revolve twelve degrees and one and one-half degree is lost in drop. There is also a loss of power when the roller jewel comes in contact with the pallet fork in unlocking the pallet. The fork is started violently in motion as at this point the balance wheel has attained its highest velocity. See that the roller jewel is set properly. The flat surface of the jewel must face out as shown in Figure 9, and it must have free play in the slot of the pallet fork. Have the jewel fastened securely because the impact is very great in proportion to the mass of pieces involved. The combined loss of power from the causes I have mentioned, amounts to not less than 25 per cent of the energy generated in the mainspring, even when the conditions are most favorable. When such is not the case, the loss is much more; in some instances amounting to nearly 50 per cent. Inasmuch as more than half the loss of power occurs in the escapement, it is obvious that great care should be exercised to see that it is properly adjusted.

Paragraph No. 6

More than one name is some times applied to the same part. Figure No. 7 is an illustration of the escapement and tells the names of the different parts. These terms will be used in this paragraph, and with careful attention you will understand the principle involved and can easily handle all of your repair jobs. When testing the escapement you first remove the watch hands and dial. Try the side shake of the roller jewel in the slot of the pallet fork. To do this, bring the balance wheel in such a position that the roller jewel is in

a direct line between the balance staff and the pallet arbor (See figure No. 10). Grasp the fork with a light pair of tweezers and the amount that it moves back and forth will indicate the side shake. It should be about one thousandth of an inch. Now rotate the balance wheel until a tooth of the escape wheel is released by a pallet stone and again try the side shake. Continue to test the side shake on different parts of the roller, it should be the same in all positions. If it should be unequal it is evidence of a defective roller table or jewel, a staff that is not true, or a bent balance staff pivot. Make a memorandum of any defects you have found and keep it for future reference. You now take a pivot broach and press the pallet fork lightly so as to bring the guard pin against the edge of the roller table (See Figure 11). Figure 11 shows three positions of the guard pin, A, B, C. If it is necessary to alter its position, bend it as shown in figure C. Rotate the balance wheel in a direction to bring the roller jewel into the pallet fork slot. If it does not enter it is an indication that the roller jewel is too far forward. You now turn the watch over, and looking through the peep-hole, with which every American watch is provided, examine the escape wheel and action of the pallet, as I shall indicate. Rotate the balance wheel until an escape wheel tooth is released from one of the pallet stones. The drop that occurs before another tooth comes in contact with the opposite stone should be at least three thousandths of an inch. You must notice the position of the tooth with reference to the locking corner of the pallet stone at the instant of dropping. This is the locking and must not be confounded with the slide, as I have explained. Rotate the balance wheel until the pallet fork is arrested by a banking screw (See figure 12). The distance that the tooth moves on the locking face of the stone is the slide and should be equal to the locking. I will try to make this clearer for you. The distance between the end of the tooth and pallet stone when the fork rests against the banking screw is the combined amount of locking and slide, each being one-half the entire distance. It must be understood that these actions are to be tested on both pallet stones and you must understand that there positively must be an extra amount of play when the pallet stone comes in contact with the escape wheel, because if the pallet does not have enough drop or extra motion, the watch will not run. When correcting any defects, in the escapement, proceed as follows: If the locking is too great push one of the pallet stones deeper into the pallet; if too light draw one of them out. By moving one of the pallet stones in or out, you alter the locking on both of them. You will have to use your best judgment in determining which stone

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to move. After you have secured the proper amount of lock and drop, you proceed with the pallet fork and roller action. The roller jewel may be moved to a limited amount forward and backward and your memorandum which you have made during the examination will tell you if it is necessary to change its position. The pallet fork may be brought to the proper position in relation to the roller by bending, or if the fork and pallet be in two parts by swinging one upon the other. The pallet fork should be in such a position that at the instant of dropping, the roller jewel will be just at the point of leaving the pallet fork slot (See figure 13). To insure this, the best way is to bring the banking screws so that the fork comes in contact with them at the instant the escape wheel drops.

These instructions have been made as brief as possible, if you will refer to the illustrations and will follow the instructions, carefully, it will be an easy matter for you to adjust and repair the escapement of any watch and clock.

The tools shown on the following pages will assist you in repairing and properly adjusting the escapement. You must have modern, up-to-date tools for doing your work. If there are any points you do not understand, do not hesitate to write to us. I will be very glad to give you special information by correspondence.

Charles F. Elmore
Instructor.

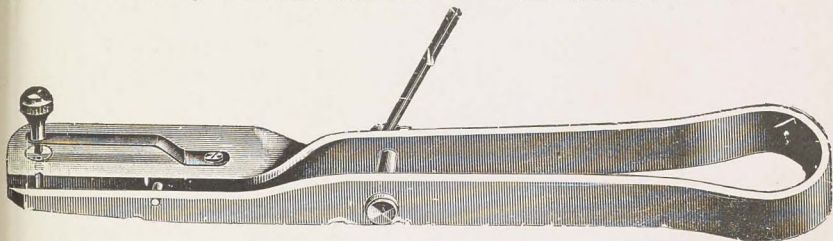
Tools for Repairing the Escapement and Balance

With proper tools you can do perfect work.



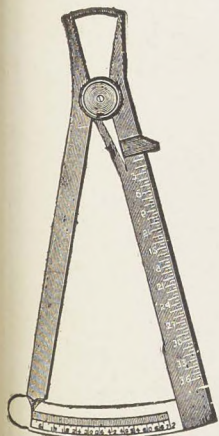
No. 3914 Improved Roller Remover.....\$1.00

This tool is also a very fine watch hand remover, as it does not injure the canon pinion when removing hands that have been rusted and are hard to remove.



No. 5031 The new Roller Jewel setter. Price.....\$0.85

Directions:—Open tweezer by means of the lever. Place the Roller Jewel in the V-slot with the flat face out, leaving a small end of the jewel project above the tweezer. Now place the roller table so the projecting end of the jewel passes into the hole intended for it. Place a small piece of shellac over the jewel and heat gradually by holding above the flame of an alcohol lamp.



No. 3100 Degree Gauge,
\$0.75

No. 3101 With set screw,
\$1.00

A Degree Gauge is used for determining the exact size of pinions and staffs and is very useful when fitting new material.



No. 4707 The Perfect Balance Screw Driver and Holder, Nickel Plated,
\$0.75

This perfect little tool is just what you want. It holds the screw after it has been removed. The screw cannot be lost or misplaced.



Balance Truing
Tweezers.
Per Set, \$1.50

These are the only Tweezers in the market especially adapted for properly truing an expansion balance.

No. 5023 Balance Truing
Tweezers.

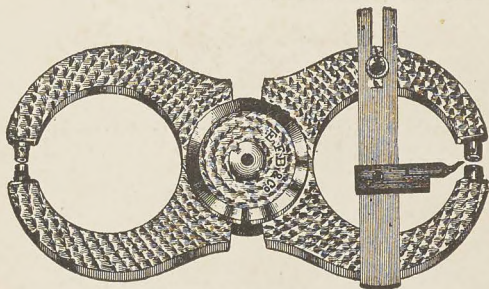
Per set, \$1.50

These are the only Tweezers in the market especially adapted for properly truing an expansion balance.

There are two tweezers in a set. If you have them it will be a very easy matter for you to true and straighten a balance wheel.

Tools for Repairing the Escapement and Balance

With proper tools you can do perfect work



No. 2710 New style Balance Wheel

Truing Calipers, \$1.95

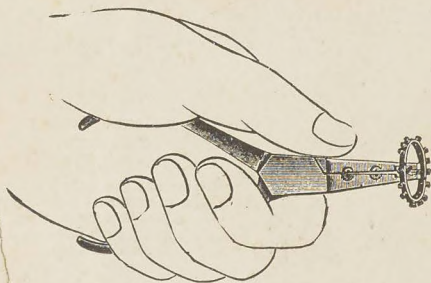
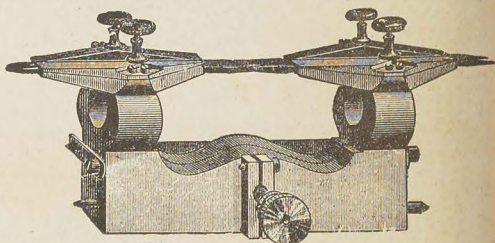
Finest Calipers on the market; nickel, Damaskeen finish.

Balance Wheel Truing Calipers are perfect tools for truing and straightening a balance wheel without breaking or bending the pivot of the balance staff; one end is fitted with an attachment for truing and straightening cylinders and train wheels. The balance wheel is the most sensitive part of a watch movement. It must be perfectly true or the watch will not run properly. This work can not be done without a first-class caliper.



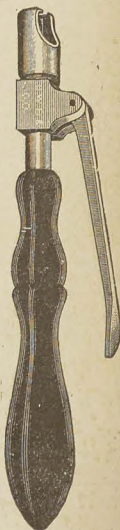
No. 2609 New Style Depth Tool. In case \$2.75

Every watchmaker, especially those who are learning the trade, should have one of these tools. It can be used for adjusting the escapement when fitting the pallet jewels, and is also used when fitting pinions in wheels. The watch movement will not run unless the teeth of the wheel work without friction in the pinion that is used for driving it. The movement parts are placed in this tool. The correct depth is ascertained by placing the movement plate on the points that project from the end of the tool.



No. 4304 New Balance Wheel Plier. Each.....\$1.00

The Plier is held in the left hand. Balance arm is held by groove in Plier near edge. Any adjustment is made by the right hand with a pair of short blunt tweezers, a fine tool for truing the balance wheel. The Plier has a step filed in jaws, permitting it to close over the balance rim without touching it when truing the wheel. The different holes in the side of Plier are used for holding roller tables and hole jewels of all sizes, while broaching hole straight without marring the edge as in the old style tools.



No. 3913 Roller Remover, \$0.95

This tool is very popular with watchmakers. The lever attachment is very sensitive, which prevents the operator from using too much pressure.

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